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(19) Eur pälsches Patentamt
European Patent Office
Office européen d s brev ts

(11) Publication number: **0 180 460**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 85307832.7

(22) Date of filing: 29.10.85

(51) Int. Cl.⁴: H 04 N 7/16

(30) Priority: 31.10.84 JP 229348/84
21.05.85 JP 110001/85

(43) Date of publication of application: 07.05.86
Bulletin 86/19

(84) Designated Contracting States: DE FR GB NL

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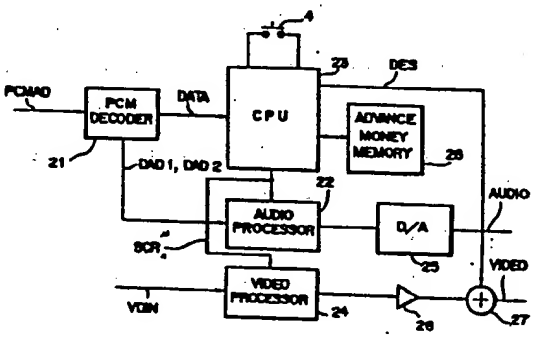
(54) **Decoders for pay television systems.**

(57) A decoder control circuit for a pay television system includes a descrambler (22, 24) for descrambling a selected video programme transmitted from a broadcast centre (9), a decoder (21) for receiving and decoding control data transmitted from the centre (9), the control data including at least programme feed data and programme status data, an advance money memory (28) for storing money data transmitted from the centre (9), and a central processing unit (23) for subtracting a programme fee from the money data stored in the advance money memory (28) upon reception of the selected programme.



EP 0 180 460 A1

DECODERS FOR PAY TELEVISION SYSTEMS

This invention relates to decoders for pay television systems.

Broadcasting systems include cable television (CATV) systems and direct-broadcasting satellite (DBS) systems. These are frequently used for pay television systems, using an appropriate converter.

In a pay television system of this type, a conventional decoder for decoding a programme of a desired channel has two main status modes; a free mode and a pay mode. The free mode allows free reception of a television programme, and the pay mode represents a status mode in which a subscriber is charged for reception of a television programme.

More particularly, the pay mode is further classified into a flat fee mode, a tier level pay mode and a pay-per-view mode. In the tier level pay mode, a tier level representing the rank of programmes to be received by the decoder is predetermined. A user subscribes to a desired tier level and pays fees to a broadcast station or centre, corresponding to the subscribed tier level. In the pay-per-view mode, the user reserves desired programmes, and pays the programme fee only for the reserved programmes to a broadcast centre.

In the pay-per-view mode, user procedures are cumbersome. When the user wishes to watch a pay programme in the pay-per-view mode according to a first known procedure, the broadcast centre posts a programme schedule to each user. The user telephones the broadcast centre by a predetermined date before a desired programme is to be broadcast (say a week or a day beforehand) so as to reserve the desired programme. At this time, the user pays the fee for the programme. When the desired programme is on the air, the broadcast centre sends a reservation confirmation signal, hereinafter referred to as an identification (ID) signal, to a user who has reserved the corresponding programme. When a user's receiver or a decoder in the receiver receives the ID signal, a scrambled programme signal is descrambled by the decoder, so that the user can watch the programme.

In the pay-per-view system described abov ;

(A) the user must telephone the broadcast centre to reserve the desired programme, which is time-consuming and may be inconvenient,

(B) each programme has a reservation due date, so that the user cannot reserve the desired programme when the reservation due date has passed,

(C) fees cannot be refunded even if the user does not watch the reserved programme, and

(D) an idle time is required to send the ID signal to all reserved users at the beginning of every reserved programme.

According to a second, improved procedure, a pay-per-view status signal is sent from the broadcast centre to each user. When the user wishes to watch a programme represented by the pay-per-view station signal, he depresses a pay-per-view switch located on his tuner. The scrambled programme is then descrambled, and the user can watch the programme. When the user actually watches the programme, charge data transmitted with the subscribed programme is stored in an account memory of the decoder. The centre periodically checks the contents of the account memory of each decoder, using a telephone line, and collects fees or bills the applicable charge.

This effectively solves the drawbacks of the first procedure. However, since the broadcast centre must periodically check the account memories of all users, the checking system is complicated. Moreover, since fee collection is performed by use of a telephone line, an auto-dial unit and a modem (modulator/demodulator) are required, so that the required user unit and centre unit are complex and expensive.

According to the present invention there is provided a decoder control circuit for a pay television system, the decoder control circuit comprising:

means for descrambling a selected video programme transmitted from a centre at a remote location;

characterised by:

means for receiving and decoding control data transmitted from said centre, said control data including at least programme feed data and programme status data;

an advance mon y memory for storing money data transmitted from said centre; and

control means for subtracting a programme fee from the money data stored in said advance money memory upon reception of said selected programme.

According to the present invention there is also provided a decoder for a pay television system, the decoder comprising an advance account memory for storing deposit data sent from a broadcast centre, means for subtracting programme fees from the contents of the advance account memory for every reception of a pay programme, and means for displaying a warning display when the contents of the advance account memory equals less than a predetermined value.

The pay-per-view mode may be classified into two sub-modes to prevent unreasonable payment. A first sub-mode constitutes a time pay-per-view for determining the charge per unit of time, and the second sub-mode constitutes a programme pay-per-view mode for determining a charge per programme. The tuner decodes a programme status code signal sent from the broadcast centre and selects either the time pay-per-view sub-mode or the programme pay-per-view sub-mode.

The broadcast centre can determine which sub-mode applies to programmes of different sorts, without interfering with the user's ability to view programmes. For instance, the programme pay-per-view mode may be employed for a special sports programme such as a boxing match programme, while other programming employs the other sub-mode. In this way a reasonable charge for any programme can be made.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a schematic diagram of a pay-per-view system applied to a DBS utilizing a broadcast satellite;

Figure 2 is an illustration of a data format of a pulse code modulation (PCM) data signal used in the DBS;

Figure 3 is a block diagram of a tuner unit shown in Figure 1;

Figure 4 is a flow chart illustrating the operational mode of the tuner shown in Figure 1;

Figure 5 is a flow chart illustrating the pay-per-view mode of the tuner shown in Figure 1; and

Figure 6 is a flow chart illustrating a control programme continuously executed by the central processing unit (CPU) of the tuner.

In the system of Figure 1, a broadcast wave from a broadcast satellite 13 is directly received by a receiving parabolic antenna 2 and supplied to a DBS tuner 1. Audio and video signals reproduced by the DBS tuner 1 are supplied to a television monitor 14. An unscrambled broadcast signal is reproduced by a decoder in the tuner 1 in the free mode. However, in the pay mode or the pay-per-view mode, a scrambled broadcast signal is descrambled and reproduced on the television screen.

When the pay-per-view mode is utilized by the user, the user deposits funds using a cash card 8 or the like, to advance money from an account within a bank 6 to a broadcast centre 9. The cash card 8 is conveniently used with an automatic teller machine (ATM) (not shown). The deposit data is transmitted from a computer 7 of the bank 6 to a computer 10 of the broadcast centre 9. The desired programme is transmitted from the broadcast centre 9 to the user through a satellite broadcast link. The deposit data is inserted in the data coded in a PCM data signal transmitted during a vertical blanking period of the video signal. The deposit data is transmitted from a transmitter 11 to the antenna 2 of each user through a broadcast parabolic antenna 12 by way of the satellite 13.

The tuner 1 of each user has an advance money memory, and the deposit data is stored therein. The content of the storage can be displayed at any time on a display 5.

The broadcast centre 9 transmits a television signal having a PCM data signal PCMAD with the format shown in Figure 2, during a vertical blanking period of the video signal. The PCM audio signal PCMAD incorporates a plurality of data slots for data of different types. Two slots correspond to two (alternately used) channels of audio data DAD1 and DAD2. Also included are a slot for the deposit money data DCIN (representing the amount of the deposited fees) and a slot for address data DADD, including the user identification (ID) code. A data code field DDCD is added to the above data string, and an error check code field DBCH is also added to the end of the data string.

The data code slot DDCD contains a frame sync code FSYN as the initial data thereof. The following data consist of the mode data word MODE, a programme status code word PROM, a channel code CHCD representing a broadcast channel number, first and second range bits REG1 and REG2 used to expand the compressed audio data, a scramble sync code SCRM used for decrambling the signal, a charge code CHAG representing the programme fees, a data code DATE, and user bits USBT.

The programme status code PROM comprises a 4-bit code signal representing the pay mode assigned to the current broadcast programme. For example, in one embodiment the programme status code PROM is set to be "0000" in the free mode and "0001" in the pay mode.

The pay-per-view mode is further classified into a time pay-per-view mode represented by a code "0101" and a programme pay-per-view mode represented by a code "0110".

The free and pay mode are, respectively, a mode for allowing free reception of programmes and a mode for subscription programmes on a monthly basis in the same manner as in the known system. The time pay-per-view sub-mode is set to charge for the length of listening time, and the programme pay-per-view sub-mode is set to charge predetermined fees for the programme regardless of reception time.

The broadcast centre 9 transmits with each programme the programme status code PROM added to the data code DDCD. A proper pay mode is predetermined in accordance with the contents of the programme by the broadcast centre 9, so that the appropriate programme status code PROM is added to the data code DDCD, and the resulting broadcast signal is transmitted to the user. Thus, fees can be charged in accordance with charging levels suitable for the respective programmes.

In the tuner 1 which receives the broadcast signal, the PCM data signal PCMAD is supplied to a PCM decoder 21 (Figure 3), located within the tuner 1 (Figure 1). The PCM decoder 21 decodes the PCM audio signal PCMAD to extract the first and second channel audio data DAD1 and DAD2 (Figure 2) which are supplied to an audio processor 22. The other data DATA are supplied to a central processing unit (CPU) 23 which is preferably a microcomputer. A video signal VDIN (which may be scrambled) in the broadcast signal is supplied to the input of a video processor 24, which is arranged to unscramble the vid o signal if necessary.

As shown in Figure 4, a step SP1 inspects the code word PROM and controls the subsequent operation accordingly. When the programme status code PROM represents the time pay-per-view mode or the programme pay-per-view mode (step SP1) a pay-per-view programme SP2 runs under the control of the CPU 23 to perform a processing step SP3.

However, when the programme status code PROM represents the free mode, a free mode programme SP4 is executed. In this case, the CPU 23 causes the audio processor 22 to decode the audio data DAD1 and DAD2 and the video processor 24 to decode the video input signal VDIN.

When the programme status code PROM represents the pay mode, a pay programme SP5 is executed under control of the CPU 23. The CPU 23 determines in a step SP6 whether or not the user ID signal included in the data DATA is the same as a unique user ID assigned to the tuner 1. If YES in the step SP6, the CPU 23 supplies the scramble sync code SCRM to the audio and video processors 22 and 24, so as to cause them to perform descrambling of the audio data DAD1 and DAD2 in a step SP7. Therefore, the audio and video signals are both reproduced. However, if the result is NO in the step SP6, the CPU 23 does not supply the scramble sync code SCRM to the audio and video processors 22 and 24, so as not to cause them to perform descrambling of the audio and data DAD1 and DAD2.

The audio signal reproduced by the audio processor 22 is supplied to a digital-to-analog (D/A) converter 25. The D/A converter 25 generates an audio output signal AUDIO. The video signal reproduced by the video processor 24 is supplied to a buffer amplifier 26. A video output signal VIDEO is generated as the sum output of an adder 27.

In the pay-per-view mode, the CPU 23 performs the processing step SP3, as shown in Figure 5. When the processing step SP3 is started, the CPU 23 checks in a step SP11 whether or not a pay-per-view switch 4 is turned on.

As shown in Figure 1, the pay-per-view switch 4 is mounted on the operation panel of the tuner 1. After the user has entered a desired channel with a ten-key pad 3, he depresses the pay-per-view switch 4, if the programme is a pay-per-view programme, which sets the tuner 1 in the pay-per-view mode. The reception channel number is displayed on the display 5. The above sequential operations are performed under the control of the CPU 23.

If the result of the step SP11 is NO (Figure 5), the CPU 23 determines that the user has to set the tuner 1 in the pay-per-view mode. Control then advances to a step SP12, and no descrambling is performed. Thereafter, the flow returns repeatedly to the step SP11. The CPU 23 thus waits until the user turns on the pay-per-view switch 4.

When the pay-per-view switch 4 is turned on by the user, the result of the step SP11 is YES. The CPU 23 then supplies the scramble sync code SCRM to the audio and video processors 22 and 24 for descrambling. The CPU 23 thus controls the generation of both the audio and video output signals AUDIO and VIDEO.

When the content of the programme status code PROM represents the time pay-per-view mode, the CPU 23 fetches this data in a step SP14, and the flow advances to a step SP15.

The CPU 23 checks in the step SP15 the length of viewing time in the time pay-per-view mode. More specifically, the CPU 23 checks whether or not a unit time has been counted by a timer incorporated in the CPU 23. If the result is NO in the step SP15, the control flow returns to the step SP11. The CPU 23 waits until counting of the unit time by the timer is completed by a loop of the steps SP11, SP13, SP14, SP15 and SP11.

When the unit time has elapsed, the result of the step SP15 is YES. The control flow then advances to a charge step SP16, in which one unit time fee is subtracted from the contents of an advance money memory 28 (Figure 3). This may be a fixed quantity, or a quantity designated by the CHAG field of the PCM data. The control flow returns to the step SP11 again to reset the timer. The CPU 23 waits for the predetermined unit time to elapse by the loop of steps SP11, SP13, SP14, SP15 and SP11.

In the same manner as described above, the CPU 23 sends out the audio and video output signals AUDIO and VIDEO which are descrambled and reproduced by the audio and video processors 22 and 24 while the time pay-per-view mode programme is being received by the user. A fee corresponding to the viewing time of the programme is subtracted from the contents of the advance money memory 28 in the step SP16.

When the user wishes to stop receiving the programme in the time pay-per-view mode, he merely turns off the pay-per-view switch 4. In this case, the step SP11 is determined by the CPU 23 to be NO, and the CPU 23 then causes the audio and video processors 22 and 24 t disable descrambling by the loops of steps SP11, SP12, SP11 ... , etc.

When the user wishes to watch programmes in the programme pay-per-view mode, the user simply turns on the time pay-per-view switch 4 of the tuner 1 in the same manner as in the time pay-per-view mode. In this case, after the step SP11 has been determined by the CPU 23 to be YES, the CPU 23 controls the audio and video processors 22 and 24 to perform descrambling in the step SP13.

In this case, the programme status code PROM included in the data DATA represents the programme pay-per-view mode detected by the CPU 23 in a step SP21. The control flow advances to a decision step SP22. The CPU 23 determines in the step SP22 whether the current programme being received is the same as the programme being received when the step SP22 last had control or whether the programme being received has been changed. If the result is NO in the step SP22, the CPU 23 determines that the same programme is being received. Then the control flow returns to the step SP11. The user can continuously watch the programme in the programme pay-per-view mode by a loop of the steps SP11, SP13, SP21, SP22 and SP11.

When the user wishes to change the programme being received, the step SP22 is determined by the CPU 23 to be YES. Then a charge is subtracted from the contents of the advance money memory 28 at the step SP23, and the flow returns to the step SP11.

Once the programme has changed, the mode is set to continue the changed programme. The CPU 23 monitors this programme by the loop of the steps SP11, SP13, SP21, SP22 and SP11.

Every time one programme has been completed or finished, the CPU 23 performs charge processing, so that the user is charged per programme, irrespective of the elapsed time.

When the user operates the pay-per-view switch 4, the mode of the tuner 1 is set to be either the time pay-per-view mode or the programme pay-per-view mode. The CPU 23 supplies to an input of the adder 27 (Figure 3) a display signal DES representing that the current programme is set in the time or programme pay-per-view mode. For example, numerical value "1" representing the time pay-per-view mode or numerical value "2" representing the programme pay-per-view mode is displayed on the screen of the monitor 14. The user can easily see the charging mode being used for the current programme.

Figure 6 illustrates a flow chart of operations continuously checked by the CPU 23. Normally, control stays in one of the loops illustrated in Figure 5. These loops are represented in Figure 6 by a fetch charge code step SP31, which passes control through a return step SP38. The return step SP38 returns control to a step SP30 which normally passes control to the fetch charge code step SP31, to define the loop of Figure 5 which is active (for the appropriate sub-mode). Periodically, the check routine step SP30 sends control to two other paths illustrated in Figure 5. Preferably this is accomplished by a signal from a timer of the CPU 23 which interrupts the normal control loop, to check the balance data maintained in the advance money memory 28 at periodic intervals, or to update the data stored in the advance money memory 28 in response to detection of data within the DCIN slot of PCMAD (Figure 2). In the loops represented by the step SP31, the charge code data CHAG superimposed on the programme by PCMAD is detected by the CPU 23, and, as previously described, when the programme or channel is changed, the step SP31 is executed.

A step SP32 receives control periodically by a timer interrupt. Alternatively, execution of the charge step SP16 or SP23 (Figure 5) may include the setting of a flag which causes the step SP30 to pass control to the step SP32. In the step SP32, the CPU 23 compares the balance of the advance money memory 28 with the charge code CHAG fetched by the step SP31. When the CPU 23 determines that the balance of the advance money memory 28 is smaller than the data represented by the charge code CHAG, the CPU 23 causes the monitor 14 to display a message representing a request for deposit in a step SP37. In this case, the CPU 23 inhibits the SCRM signal, so that the programme cannot be watched. The deposit data is checked in a step SP33. The step SP30 passes control to the step SP33 periodically, by a timer interrupt, so that the control data PCMAD may be checked for deposit information. Alternatively, the step SP30 may check each incoming control word PCMAD for deposit data and branch to the deposit routine step SP33 whenever data is detected within the DCIN field. When deposit money data DCIN is detected as present in the step SP33 (Figure 6), the CPU 23 checks the ID code included in the address data DADD. In this case, if the result is YES in a step SP34, the deposit money data DCIN is added to the content of the advance money memory 28 in a step 36. When all the routines have been completed in Figure 6, the flow

returns from the step SP38. Preferably, the advance money memory 38 comprises a non-volatile memory device such as an MNOS semiconductor RAM.

With the above arrangement, the pay-per-view mode for designating a pay programme is classified into time and programme pay-per-view sub-modes. Charging is determined in units of time or programmes. Therefore, a reasonable charging system suitable for the purposes of users can be established.

A desired programme need not be reserved by telephone, and the user can conveniently enjoy the DBS system. If the user does not watch a reserved programme, no charge is made. Moreover, when the pay-per-view switch 4 is depressed, the user can watch any programme at any time, provided the sum stored in the advance money memory 28 is enough.

Since the user is not charged through a telephone line (bidirectional communication system), the configuration of the user's receiver and the broadcast centre system can be simplified and made less expensive. The user simply receives a message via the step SP37 representing a request for a deposit when the value of the advance account memory is less than the predetermined value which is needed for viewing a particular programme. The user pays a fee in accordance with the message, or else has it automatically deducted from the advance money memory 28, so that a simple efficient system can be provided. In the pay-per-view system of this embodiment, the transmission line from each user to the centre comprises a link through a bank or the like. Such a link may be located at the user's home, or a public link may be used such as the link of a bank's ATM. Programme fee data, deposit amount data, and the like are sent from the broadcast centre 9 to the user through a transmission line using the regular broadcast channel as shown in Figure 1. Shortage of a deposit amount is automatically displayed by the user's monitor 14. Therefore, a conversational two-way communication between the user and the broadcast 9 is provided, although only a one-way line terminating at the user's home is actually used.

The broadcast centre 9 may, but need not, send the ID signal to all users when payment data is obtained. Many control words relative to payment data can be sent to users within a limited time, and additional information such as a text or message can be sent, if desired.

The above embodiment exemplifies a DBS system. However, the present invention can be applied to other pay broadcast systems such as a CATV system. The invention can also be applied to an audio pay broadcast system.

Alternatively, in the above embodiment, the fee corresponding to the actual viewing time detected by the timer incorporated in the CPU 23 can be subtracted from the contents of the advance account memory periodically, by means of a timer interrupt procedure, which is enabled during the course of a pay mode.

CLAIMS

1. A decoder control circuit for a pay television system, the decoder control circuit comprising:

means (22,24) for descrambling a selected video programme transmitted from a centre (9) at a remote location;

characterised by:

means (21) for receiving and decoding control data transmitted from said centre (9), said control data including at least programme feed data and programme status data;

an advance money memory (28) for storing money data transmitted from said centre (9); and

control means (23) for subtracting a programme fee from the money data stored in said advance money memory (28) upon reception of said selected programme.

2. A decoder control circuit according to claim 1 wherein said control means (23) includes a manual switch (4) for selectively allowing descrambling of said programme when said programme is a pay-per-view programme, as represented by pay-per-view status data in said control data.

3. A decoder control circuit according to claim 1 wherein said control means (23) includes means to inhibit the reception of said programme when said programme fee data exceeds the money data stored in said advance money memory (28).

4. A decoder control circuit according to claim 3 wherein said control means (23) further includes display means (14) for displaying a message giving reasons for inhibiting the reception of said programme.

5. A decoder control circuit according to claim 1 wherein said advance money memory (28) includes means for verifying an identification code transmitted with said control data and for selectively prohibiting the storing of said money data when said identification data transmitted in association with said money data does not coincide with the individual identification code of the decoder with which said control circuit is associated.

6. A decoder control circuit according to claim 2 wher in said control means (23) includes timer means arranged to measure the time during which said programme is received, and for controlling said subtraction based on the measure of reception time.

5

7. A decoder control circuit according to claim 6 including means for activating said timer means when said manual switch (4) is turned on, and for deactivating said scrambling when said manual switch (4) is turned off during the period of reception of a time pay-per-view programme.

FIG. 1

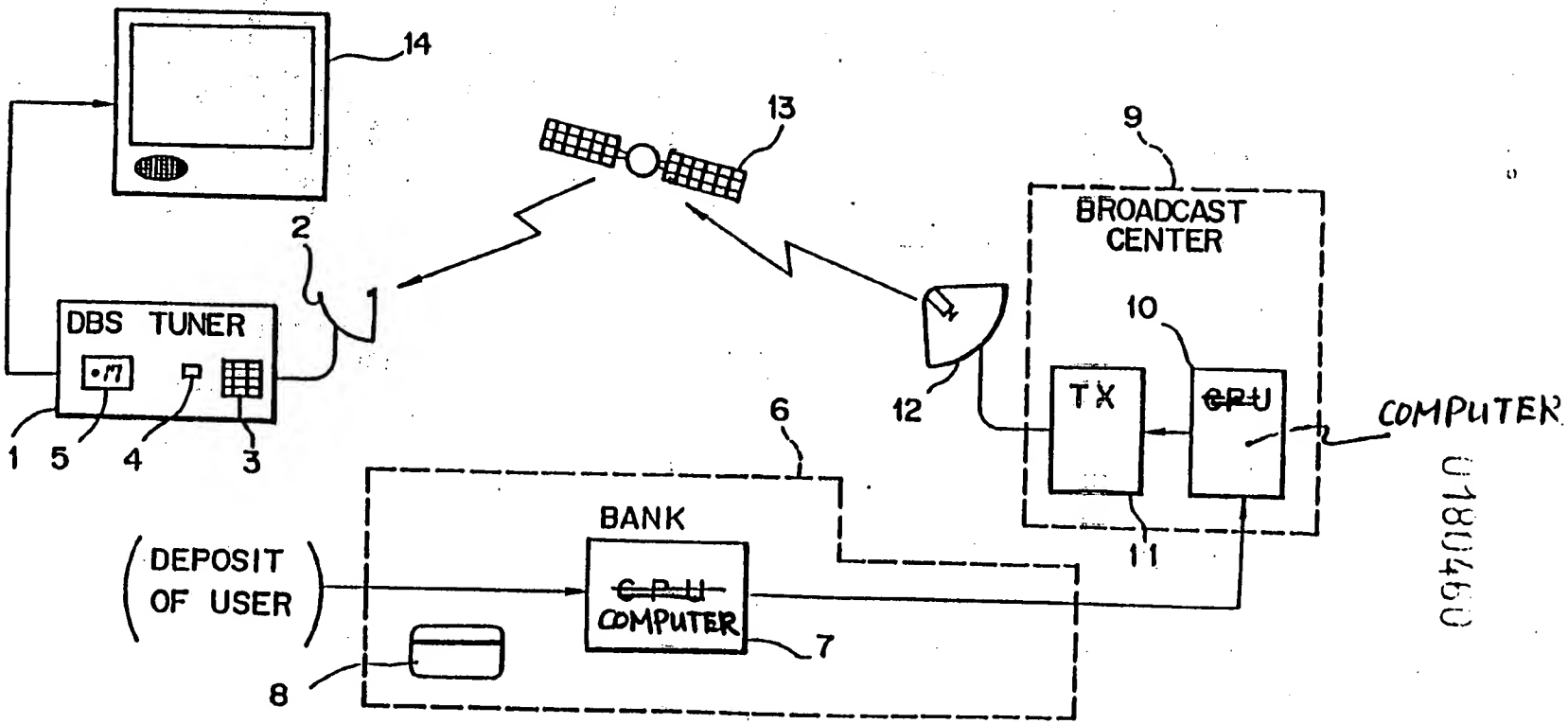


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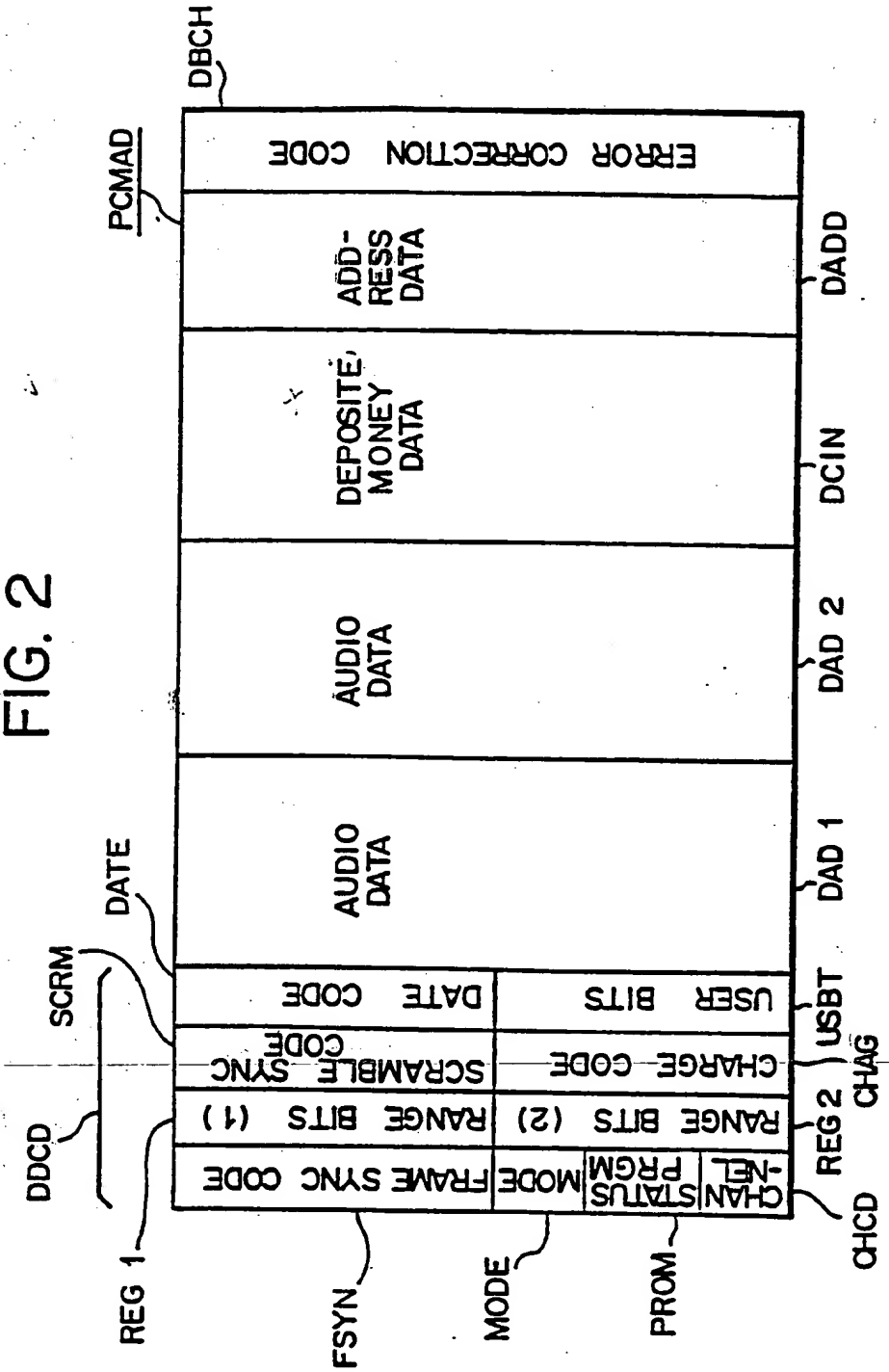
FIG. 2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PCMAD
ERROR CORRECTION CODE
ADD-RESS DATA
DADD
DEPOSITE, MONEY DATA
DCIN
AUDIO DATA
DAD 2
AUDIO DATA
DAD 1
DATE
SCRM
USER BITS
USBT
DATE CODE
SCRAMBLE SYNC CODE
CHARGE CODE
CHAG
RANGE BITS (1)
RANGE BITS (2)
REG 2
DDCD
FRAME SYNC CODE
MODE
STATUS PRGM
CHAN-NEL
CHCD
REG 1
FSYN
MODE
PROM

FIG. 3

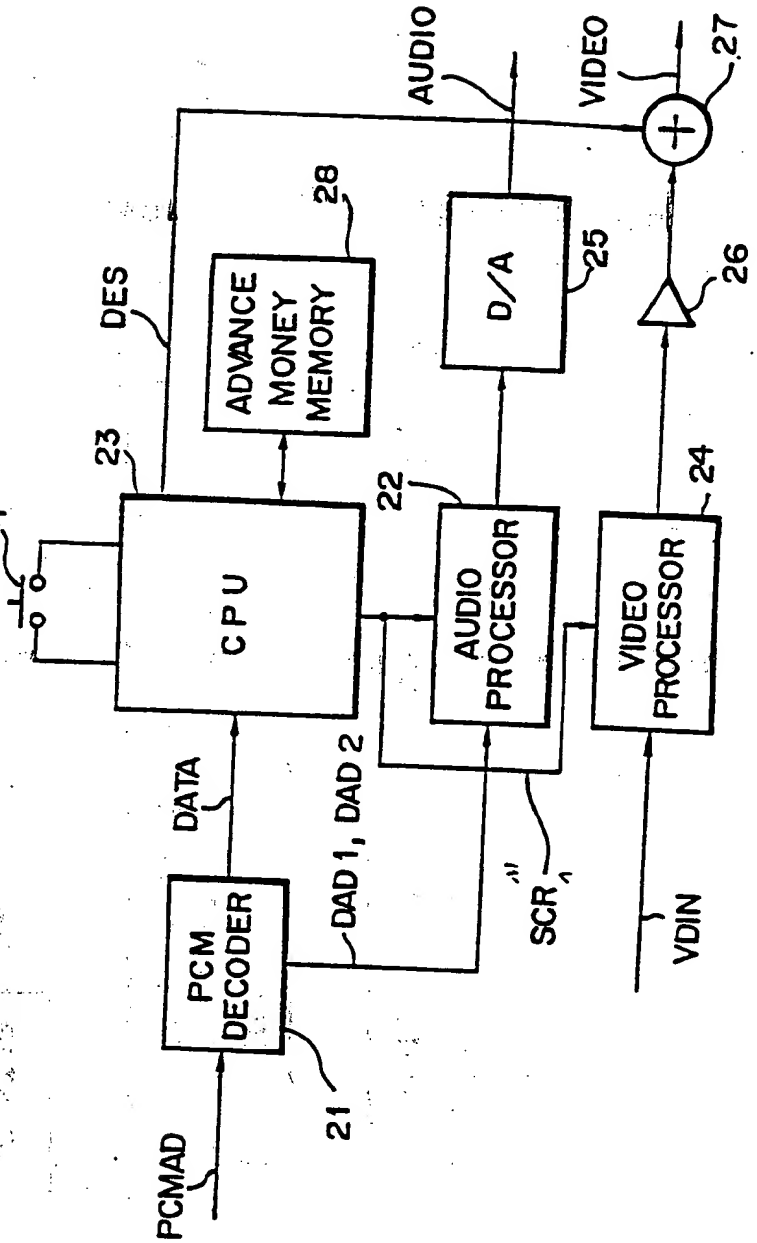

AUDIO
VIDEO
27
28
DES
ADVANCE MONEY MEMORY
D/A
25
26
23
22
24
4
CPU
AUDIO PROCESSOR
VIDEO PROCESSOR
DATA
DAD 1, DAD 2
SCR
VDIN
PCM DECODER
21
PCMAD

FIG. 4

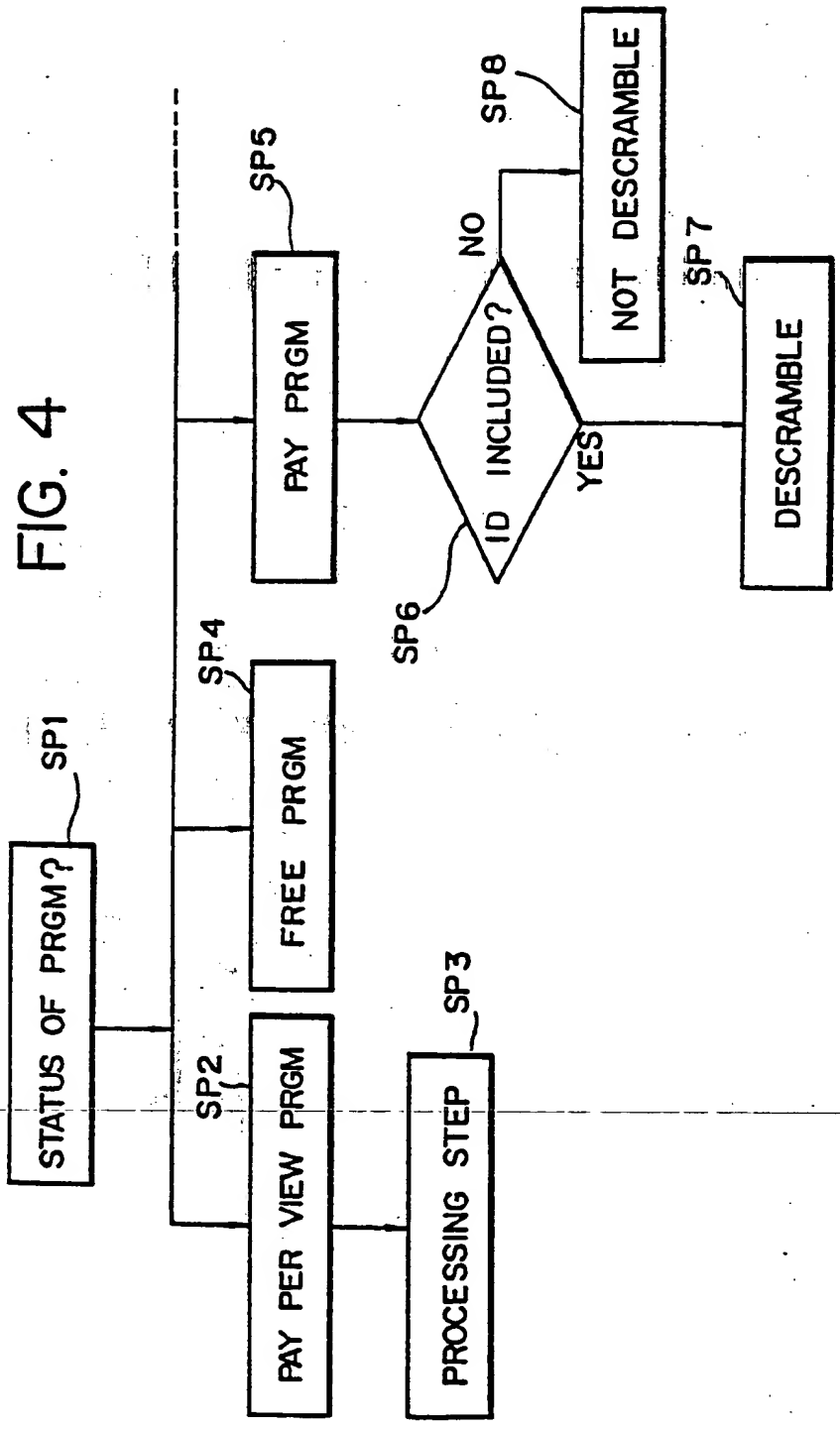
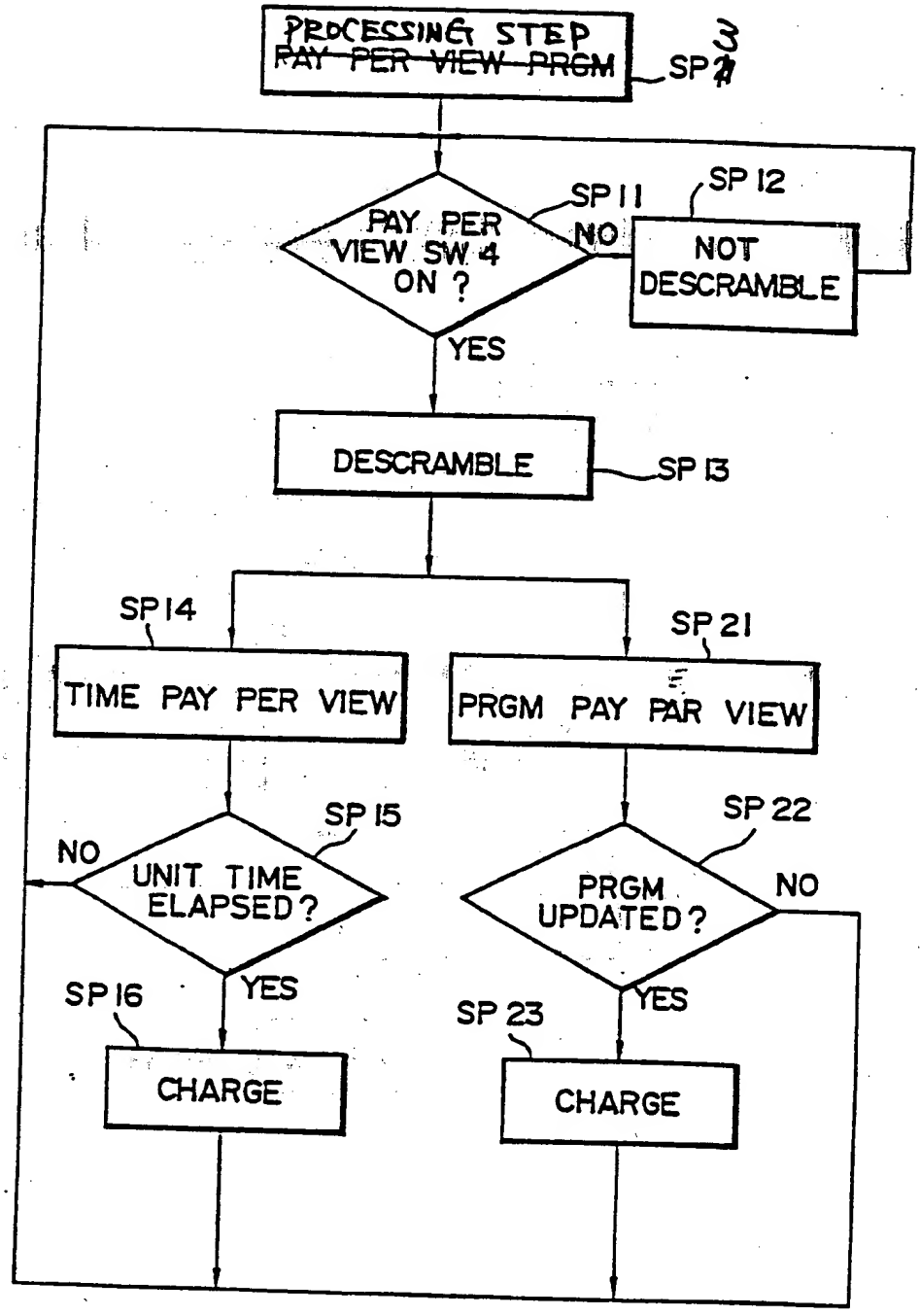
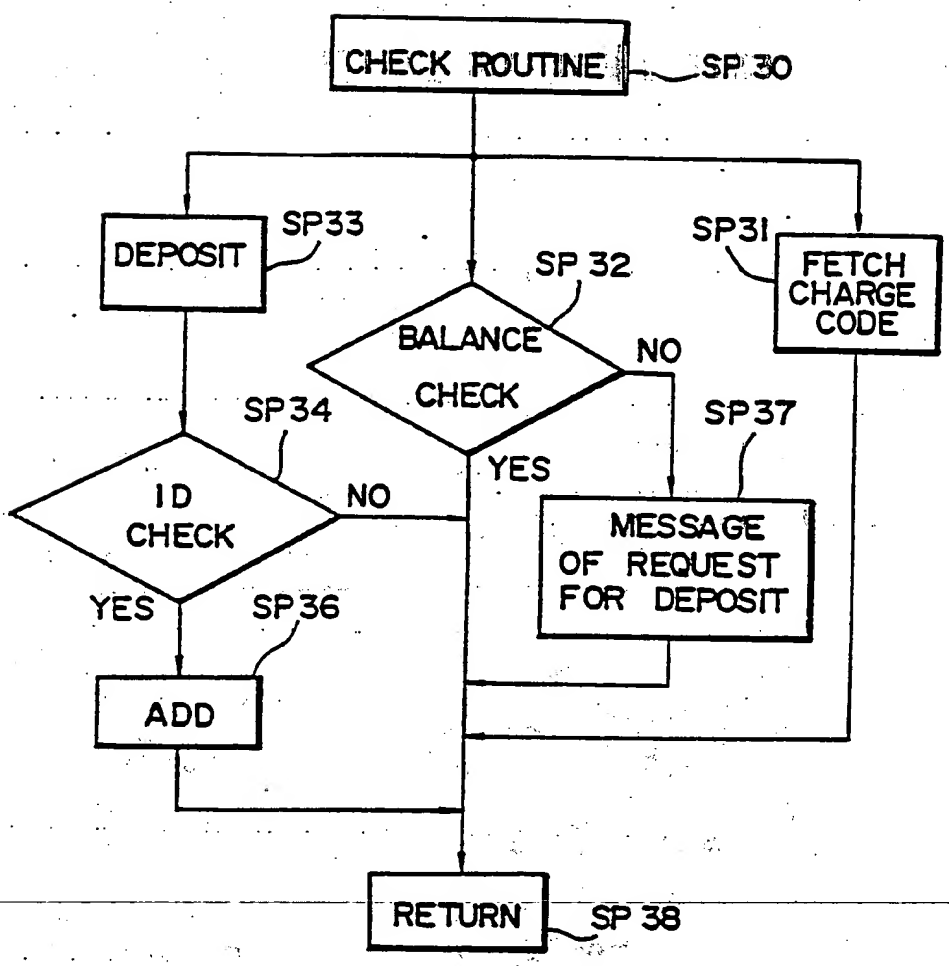

STATUS OF PRGM?
SP1
FREE PRGM
SP4
PAY PER VIEW PRGM
SP2
PROCESSING STEP
SP3
PAY PRGM
SP5
ID INCLUDED?
SP6
NO
YES
NOT DESCRAMBLE
SP8
DESCRAMBLE
SP7

FIG. 5


PROCESSING STEP
PAY PER VIEW PRGM
SP 3
SP 11
SP 12
PAY PER VIEW SW 4 ON ?
NO
NOT DESCRAMBLE
YES
DESCRAMBLE
SP 13
SP 14
SP 21
TIME PAY PER VIEW
PRGM PAY PAR VIEW
SP 15
SP 22
NO
UNIT TIME ELAPSED?
PRGM UPDATED?
NO
SP 16
YES
YES
SP 23
CHARGE
CHARGE

0180460

FIG. 6



European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 85307832.7

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	WO - A1 - 83/04 154 (TELEASE)	1-4	H 04 N 7/16
A	* Abstract; fig. 1-4; page 9, line 12 - page 33, line 22; page 35, lines 3-14 *	6	
Y	EP - A2 - 0 052 822 (AVM SCHMELTER)	1-4	
	* Totality *		
A	US - A - 4 460 922 (ENSINGER)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 04 N 1/00
H 04 N 7/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	24-01-1986	BENISCHKA

CATEGORY OF CITED DOCUMENTS

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